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ABSTRACT

The revolution in telecommunications technology will be a driving force in the future economic growth of rural areas. Federal and state universal service policies requiring delivery of service to rural areas were major factors in how the telephone system evolved during the 20th century. In the 1990s, telephone penetration rates were similar for rural and urban areas but differed significantly across ethnic groups, income groups, and regions of the country. Between 1994 and 1997, the number of households with personal computers increased about 50 percent, and the growth in modems and email was much greater. However, Hispanics and Blacks lagged behind other groups in these areas. Installation of new telecommunications technology enabling quality data transmission, such as digital switching and fiber-optic cable, is demand-driven and occurs in richer and urban areas first. Since Internet use depends on quality data transmission and the growth of Internet commerce is expected to be a significant part of future economic growth, communities characterized by low income, such as those of Hispanics, other minorities, rural areas, and center cities, are disadvantaged in terms of future economic development. Universal service provisions would address this economic and social challenge, but there continues to be much debate on what universal service should constitute with regard to new telecommunications technology. (Contains 10 references.) (TD)

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Telecommunications in Rural Economic Development: Issues for Latinos and Other Communities

by Peter L. Stenberg
U.S. Department of Agriculture

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August 2000

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Telecommunications in Rural Economic Development: Issues for Latinos and Other Communities

by Peter L. Stenberg
U.S. Department of Agriculture

Occasional Paper No. 62
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Abstract:

A debate is taking place in the country about the universal service provision of modern telecommunications services. The debate revolves around two questions. First, if many communities, and significant segments of the population, are not able to participate fully in the modern Information Age will it result in their impoverishment? Second, if there is too great a policy and regulatory intrusion in the market place will that cause significant misallocation of resources causing the entire society to be impoverished? It is a debate with a mixture of facts and some conjecture. The purpose here is to bring forth the basic telecommunication facts, as we currently know them, relative to rural and Latino communities.

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Dr. Stenberg is an economist at the Economic Research Service, U.S. Department of Agriculture. Prior to joining ERS, he was a faculty member at the University of Minnesota and Hamline University. He conducted research with respect to North American,African, and Eastern European economies covering topics in economic development policy and human and physical infrastructure. He has written articles on telecommunications, economic impact of universities, science and technology policy, defense restructuring, high tech industry, and other economic development subjects. He received his Ph.D. in applied economics from the University of Minnesota. Dr. Stenberg can be reached at <stenberg@ers.usda.gov>.

This paper was presented at the Julian Samora Research Institute's "Latinos, the Internet, and the Telecommunications Revolution" conference, Michigan State University, on April 27, 1999.

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East Lansing, Michigan

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Telecommunications in Rural Economic Development: Issues for Latinos and Other Communities

A Little History

The history of telecommunications in rural areas tells us how we arrived at the system we have today. It also underlies the policy debate of today. At the start in the late 19th Century, the Bell system held all the patents and the company collected monopoly rents impeding a wide adoption of the new technology. The telephone system was restricted to areas with enough wealthy customers, generally only the largest urban areas (Dyson).

When the patents expired, a host of new companies formed and entered hitherto unserved markets and costs of service declined. Professionals, such as doctors, saw the usefulness of telephones and invested in local systems. The telephone system, however, still was largely confined to urban areas (Dyson). Telephone companies saw the critical mass of customers needed to make systems profitable to be lacking in most rural areas (beyond outskirts of sizeable towns).

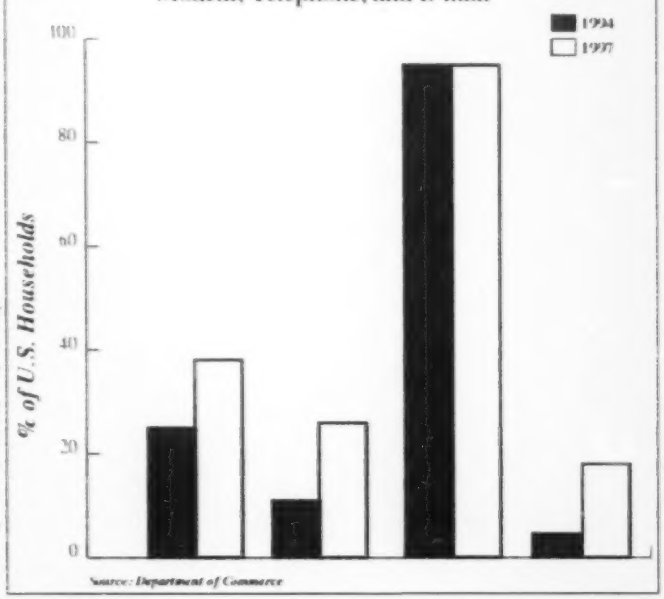
In more prosperous rural regions farmers built their own local systems buying equipment from Sears Roebuck, Montgomery Wards, and other manufacturers and retailers of telephone equipment. The systems varied from relatively sophisticated to quite primitive. In some cases so primitive that the telephone line was a strand of barbed wire (Hatfield). Difficulties arose, however, with the refusal of the Bell System and many of the independents to allow these rural systems to connect to the urban systems and networks. Despite these handicaps rural telephone systems grew rapidly, though never were they in universal service.

The Great Depression brought the growth of the telephone system to a standstill with many customers no longer able to afford the luxury of telephones. It was not until the passage of the New Deal's Communications Act of 1934 that universal service was promised (i.e. telephone service at affordable rates were promised for all households). It was not until the passage of the Hill-Poage Act in 1949 that real progress was made in bringing telephone service to all rural areas was made. By 1964 over three-fourths of the farms had telephone service, by 1980 only the most remote areas did not have telephone service. Today approximately 96% of households have telephone service, nearly the same ratio for farms. The remaining households either chose not to have phone service, could not afford even the subsidized phone service, or live in very remote locations.

The Telecommunications Act of 1996 is starting to change the existing system (the prior-1996 regulatory system had to be changed because of progress in telecommunication technology and the resultant change in the dynamics of the economics driving the system). The new technologies and regulatory environment have brought a good deal of uncertainty to the issue of providing universal service.

What some fear today is a repeat in this early history of telecommunications service for rural and poor communities. This is at the center of the current debate over the provision of universal service in telecommunications. The 1934 Act and subsequent bills, however, have largely made the telecommunications system as accessible as it is today.

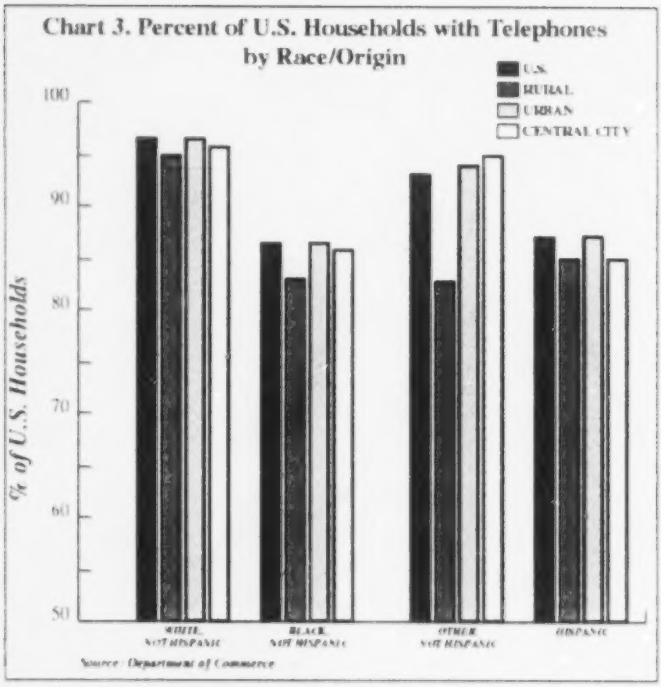
Chart 1. Percent of U.S. Households with a Computer, Modem, Telephone, and E-mail



Current Status

The Department of Commerce household surveys offer the most complete picture of the diffusion and use of the new technologies in the private sector. While telephone penetration has remained fairly constant during the 1990's, the percentage of households with personal computers has increased significantly. From 1994 to 1997 the number of households with personal computers increased roughly 50% (Chart 1). The growth in modems and e-mail, reflecting the rise in Internet demand, was much greater. The widening household personal computer and Internet penetration means that the demand for higher quality telecommunication systems also is increasing.

Rates are not constant across the country, income groups, or ethnic groups. While the rate of telephone penetration remained relatively constant for the national aggregate, it rose slightly, not (statistically) significantly, for the rural region (Chart 2). Success of the universal program is evident, rural regions, on the aggregate, do not trail the national average. Though the raw data suggests the rural region has a slightly greater level of telephone penetration than the urban region, the difference is not statistically significant.



The penetration rates vary significantly across ethnic groups (Chart 3). Telephone penetration for the Hispanic population is significantly below the national average. The rate for the Hispanic population does not, however, vary significantly across rural and urban regions. This lack of variance across regions indicates that there is another factor explaining the difference between the rate for the Hispanic population and the general population.

The variance across ethnic groups (Chart 3) can be explained, in large part, by differences in income across ethnic groups. While the difference in telephone penetration is not significantly different across ethnic groups for households with annual incomes greater than $35,000, the difference is great for households below the poverty line (Chart 4). The variance across income groups, however, would be much greater if not for the universal program.

Telephone penetration does vary significantly across regions of the country (Chart 5). The greatest difference is between rural regions in the Northeast and the South. This difference is largely due to differences in household income between the regions. The success of the historical universal service program is evident, the variance across regions would be much greater without it (primarily because of the household income and service delivery cost differences).

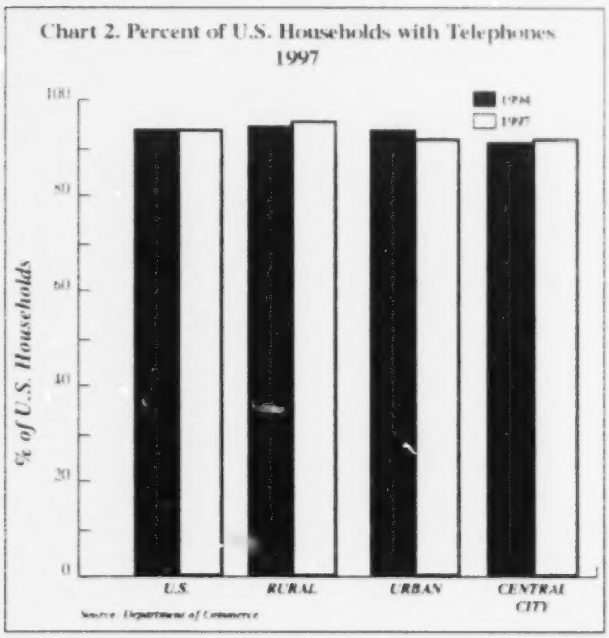
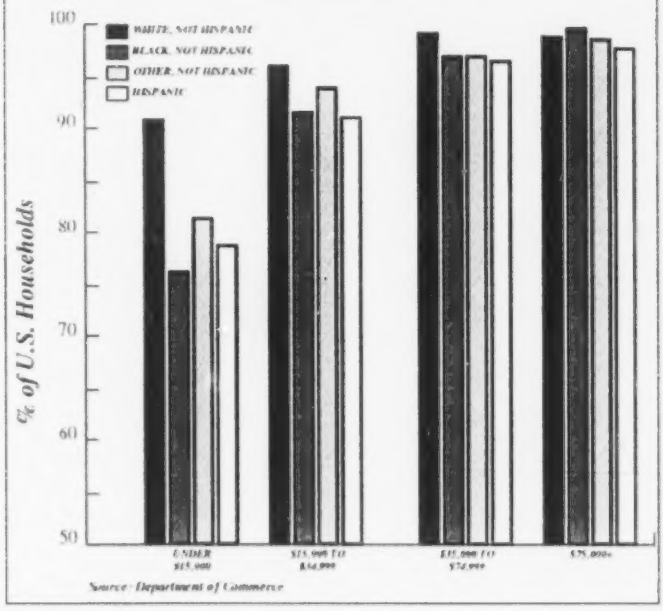


Chart 4. Percent of U.S. Households with Telephones by Income, 1997



Technology

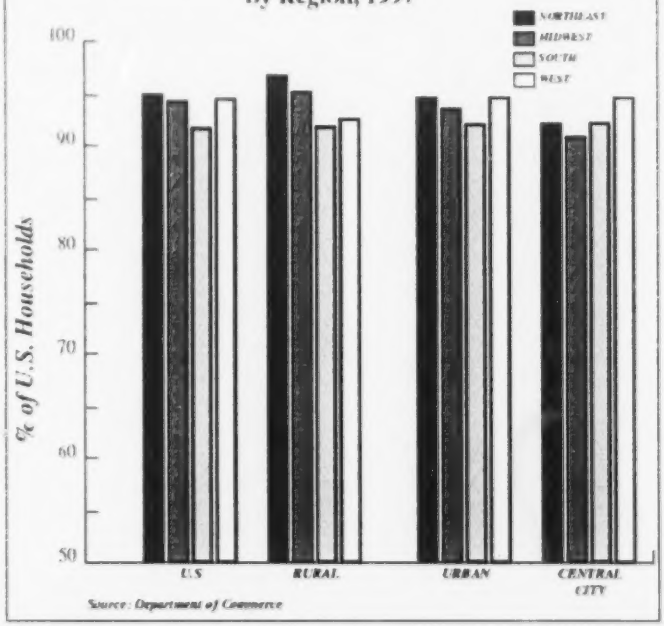
You cannot get far in the discussion of rural telecommunications before coming to the issue of technology. To state the obvious the quality and availability of telecommunications is determined by technology and the cost thereof. It was the rule at the onset of the telecommunications industry as it is today

The current national telecommunications network mirrors in many ways the highway system in the 1950's and 1960's. Fiber optic telecommunication networks, like the interstate system earlier, are growing rapidly. Like the freeway systems, rural communities are in danger of being left bypassed without any on- and off-ramps. Although there are exceptions, generally rural areas will be at a disadvantage vis-a-vis urban areas when it comes to the rollout of new telecommunication technologies. All other things being equal, rural areas are less likely to muster the demand needed to justify or amortize investment in all advancements in telecommunication infrastructure.

If rural communities are unable to keep pace with urban areas in the investment of new telecommunication infrastructure the local quality-of-service will suffer. As the experience with personal computers has taught us, new technology will increasingly be needed for access to the latest, as well as the full range of, multimedia material.

The economic disadvantages in the delivery of telecommunication services for rural and poor communities have historically been addressed within federal and state universal service legislation and regulation. Under early federal legislation universal service was simply the ability to make quality voice transmissions with some great degree of service reliability. The 1996 Act ushered in a broader universal service prescription. The new legislation, and previous regulatory actions, includes additional services, such as 911 emergency number service and the availability of quality data transmission. The most significant of these additions to universal service provisions is an evolving one, but one not yet implemented. The new provision includes Internet service, i.e. quality data transmission, in the universal service program (Stenberg, et al)

Chart 5. Percent of U.S. Households with Telephones by Region, 1997



While there have been many advancements in communication technology, for all intents and purposes quality voice and data transmission is dependent on the current phone systems. The crux of the problem for the delivery of quality voice and data telecommunication service to private residences has been the so-called problem of the last-mile. First, the cost of running fiber optic cable to each single-family residence has been estimated to be $3,000 per household. This is an economic fact for rural and urban areas.

Second, the quality of service, given the current telecommunications system architecture, is dependent on what are called central office switches. Quality of telephone service is dependent on the capabilities of these switches and the distance the customer is to it. For speed and reliability of transmission, digital switches are needed. Current technology for residential customers uses ISDN (Integrated Services Digital Network). ISDN is the benchmark by which new technologies are compared. Digital switches combined with fiber-optic cable produces cost savings due to the reduction of training and maintenance costs (Majumdar). Digital switches permit adding new services that bring the carrier additional revenue (Majumdar).

Despite the advantages of digitalization and the declining costs of equipment, conversion from analog switches has been slow. In fact ISDN technology has been around for over 25 years. In 1990 less than 10% of the U.S. network was digital (Malecki and Boush). Some attribute the slow adoption to the investments in analog systems during the 1980's (Majumdar). With sunk costs the telephone companies have been reluctant to quickly replace the analog systems.

Investments in the digital switches follow the same pattern as the early development in the telecommunications industry. The first investments primarily took place in the larger urban and wealthier markets where the returns on the investment were higher. Digital switch investments came later to secondary and tertiary markets as the equipment cost declined with the maturation of the technology (Egan).

In a study of Tennessee, Malecki and Boush found an urban bias in the quality of digital switches. Most of the switches located in non-metro areas had minimal digital capability. They also found that the land area served by the average metro switch half the size as the nonmetro switch. The greater land area means it costs more to reach each nonmetro customer.

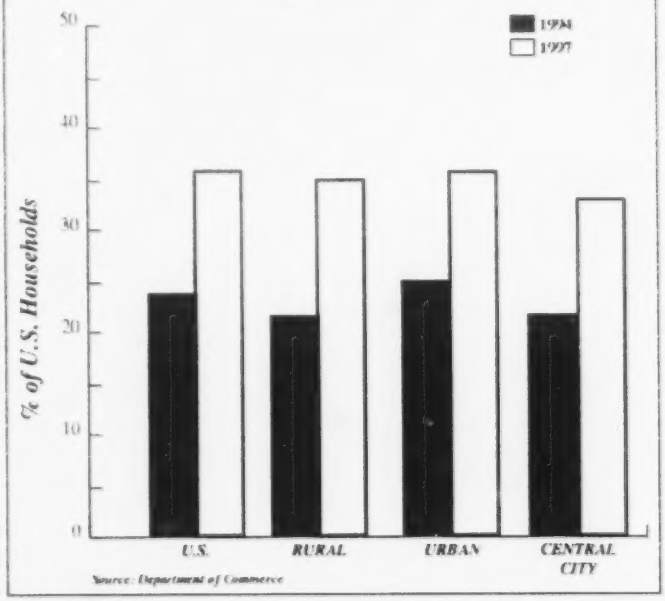
Rural Telecommunication Services Demand

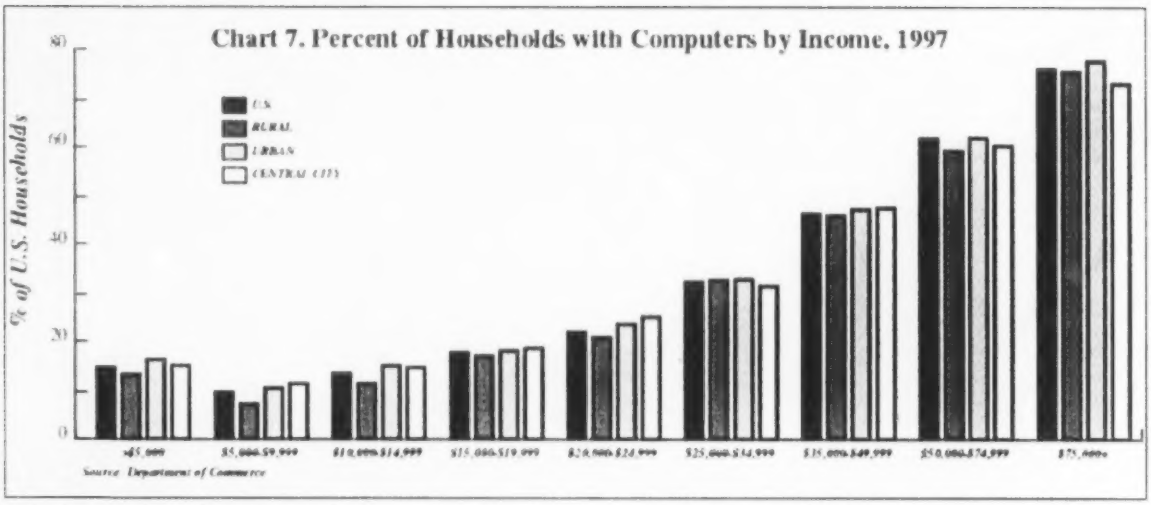
Despite the slowness and the limits in the diffusion of new telecommunication technologies to rural areas it is taking place. With the availability of the new technologies come new rural business activity and in-migrants. With new technologies and new business comes increased demand for better rural telecommunications networks.

The Department of Commerce survey of computer use indirectly shows the increasing demand in rural areas for advanced telecommunications systems. The increase in Internet traffic corresponds to the increase in personal computer ownership rate. Increasing Internet traffic increases the demand for high quality telecommunication services.

The rate of computer ownership grew rapidly between 1994 and 1997 (Chart 6). Rural households were less likely to own computers than the national average, but the rate was not (statistically) significantly lower. Computer ownership rates grew greatly

Chart 6. Changes in Percent of Households with Computers 1994-1997





in both rural and urban regions. Increased household penetration was caused by three major factors: rapid declines in the price of personal computers, economic prosperity (and resultant low unemployment rates) experienced during the 1990's, and rise of the Internet.

Computer ownership varies greatly across income groups. Chart 7 shows a classical demand curve for personal computers in households with household ownership more likely as income is greater. Within income groups there was no (statistically significant) differences across rural and urban areas.

The variance in household ownership is great across ethnic groups (Chart 8). Hispanic households were less likely to own computers (than the national average). Ownership by Hispanic households, however, grew significantly between 1994 and 1997. The rate of ownership across rural and urban areas is fairly even within the Hispanic and White (not Hispanic) ethnic groups. The great poverty among rural Blacks in the South and on the tribal reservations in the West may explain the greater rural-urban variation within the other two ethnic groups.

Some variance exists within income groups by ethnic group (Chart 9). Hispanic households with incomes less than $75,000 are less likely to own personal computers than White (not Hispanic) households. No (statistically significant) difference exists between these ethnic groups for wealthier households. The income effect, is a significant factor explaining the difference in computer ownership rates between Hispanic households and non-Hispanic households.

Economic Consequences from the Telecommunications Revolution

The telecommunication revolution is shaping the activities of enterprises in rural and poor communities (Bryden and Sproull; Stenberg, Rahman, Perrin,

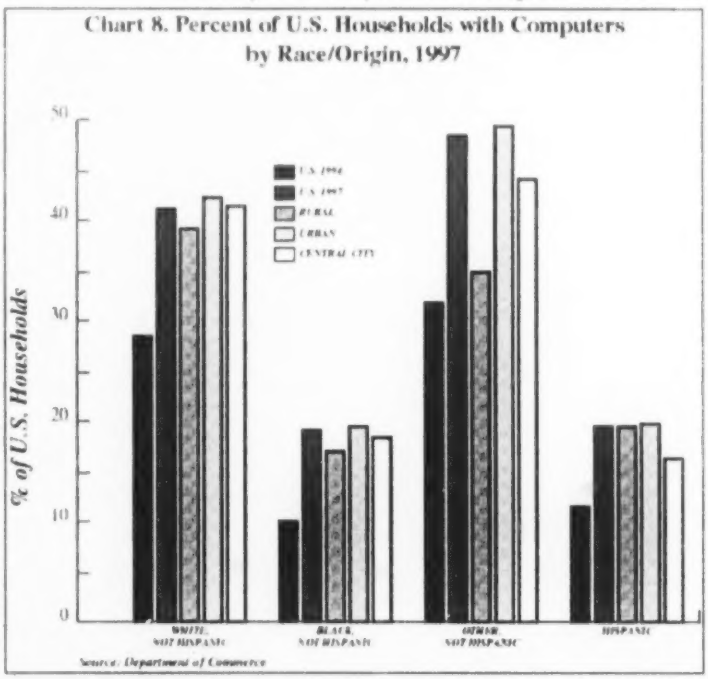


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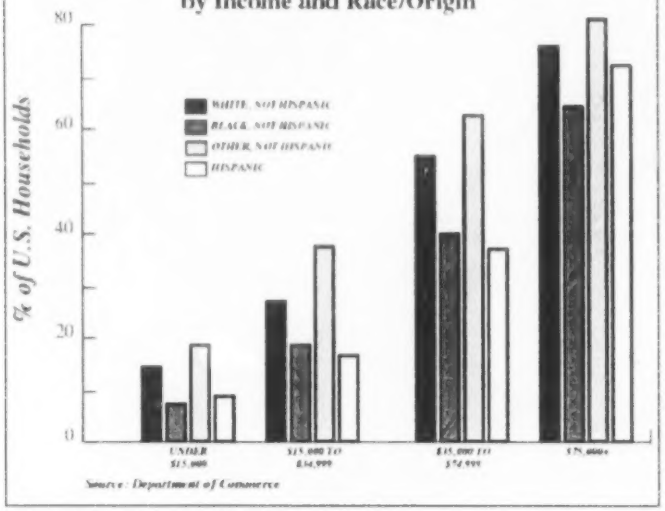
Chart 9. Percent of Households with Computerss by Income and Race/Origin



and Johnson). The effect of the revolution, however, varies by type of economic activity and the telecommunication embeddedness. In some cases the effect on rural and poor communities is positive and in others, negative. In framing local development strategies pay close attention to the type of economic activity and telecommunication system adopted is needed (Bryden and Sproull).

Many in the popular press have argued that the new communication and information technologies are loosening place-of-work spatial constraints. People, will therefore be increasingly likely to choose the place of residence by other factors over the more traditional job location factor. Salant, et al, analyzed this issue with respect to rural areas. They examined recent migrants to rural Washington State and identified what has been termed "lone eagles" in the popular press. They found that lone eagles make up only a small portion of rural in-migrants in the state. Lone eagles are just as likely to move to urban areas as rural areas. The lone eagles no matter where they live, however, have a disproportionate effect because of their greater wealth and education. One reason that some rural areas and poor communities are trying to attract them.

Salant could not conclude that the new technologies are causing the deconcentration of population, but she showed significant numbers of new rural residents use the new technologies. Findings imply that rural and poor communities need affordable high quality telecommunication services to retain current, and attract new, residents.

Call centers, back office establishments, and other similar operations dependent on quality telecommunication services have been advocated by local economic development planners as good firms to target. These firms contribute to local economic development in four basic ways. First, they bring a significant number of jobs. They often bring new forms of jobs and help develop the job skill base in rural and poor communities. Lastly, they new bring in new telecommunications investment (Richardson and Gillespie).

The catch for attracting call centers and other similar operations, however, lies in two basic questions. First, do rural and poor communities have enough skilled labor for the firms? Second, do rural and poor communities have sufficient in place telecommunication technology for these firms? As Richardson and Gillespie and others have argued, investment is demand driven. As a consequence – without market intervention by government – rural and poor communities often receive new telecommunication investment last. As a consequence they are at a disadvantage vis-a-vis urban areas in attracting call centers and similar establishments.

Rural areas and poor communities may already be losing out in the rapid development of new telecommunication services. Stenberg, Isserman, and Young examined the mail order business. The business is increasingly moving toward an Internet-based environment. As a consequence industry is increasingly dependent on the most advanced telecommunication systems. The key components in these networks are digital switches. As Malecki and Boush have shown, these switches are more likely to be in urban and richer areas. Digital switches are not identical, the more capable the switch the more likely it will be located in urban and richer areas. During the 1990's the mail order industry has been consolidating in more urban locals where telecommunication services are better (Stenberg, Isserman, and Young). This may be evidence that rural and poor communities are starting to fall economically behind richer urban counterparts.

Summary and Conclusion

The revolution in telecommunication technology will be a driving force in future economic growth. Federal and state policies have been major factors in how the telecommunication system has evolved during the century. They will still play a critical part in the development of new and more advanced networks. Debates will revolve around the nature and degree of policy intrusion into the market and what constitutes good policy or bad policy. The debate over universal service provision for poor and rural communities has been a significant question for sometime.

The demand driving the development and diffusion of new telecommunications networks will continue to evolve. The Internet's growth in commerce has so far exceeded earlier predictions. While the future of Internet commerce seems great it is not likely to be as great as some of stock market valuations for Internet companies would indicate. The growth of Internet commerce, however, will be a significant part of future economic growth.

Poor communities and rural areas that lack great demand for and supply of telecommunication services will fall behind increasingly behind the richer urban areas of the country. The universal provisions will try to address this economic and social challenge, but, as has been seen in the popular press, the debate will continue for sometime on what universal service should constitute.

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